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ABSTRACT

Contained in this guide are announcements of references and audio-visual courses on the metric system and related fields available at the Marshall Space Flight Center. Included by sectional entries are listings of: (1) books, (2) reports, papers and articles, (3) periodicals, (4) film strips, (5) posters, (6) education and training courses, (7) materials produced by the International Organization for Standardization, (8) materials produced by the International Electrotechnical Commission, (9) conversion tools, (10) addresses of sources from which other information can be obtained, and (11) sources from which metric tools, instruments and components can be obtained. (SN)

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November 1, 1972

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SUBJECT: Information on the Metric System and Related Fields

The attached handout, fourth edition, containing pertinent information on the metric system and related fields available at the Marshall Space Flight Center, is forwarded for your use and retention. It may serve you as a quick reference to metric information which is still scarce and scattered.

Though compiled with care, no responsibility for possible errors or omissions are assumed.

This handout will be updated from time to time; your comments/ suggestions and reference to not-yet-listed metric information, you may be aware of, will be appreciated.

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Information On The Metric System & Related Fields

Fourth Edition

Nov. 1, 1972

A. BOOKS

	Call No.*
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NBS-SP-345- 3:	Commercial Weights and Measures	"
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NBS-SP-345-10:	A History of the Metric System Controversy in the U.S.	"
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* Complete sets of these reports are available in Huntsville, AL, from:
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** Report illustrations are also available on 35 mm slides for presentations. Microfiche edition available from the National Microfilm Association, Suite 1101, 8728 Colesville Road, Silver Spring, MD 20910.

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71. Metrication Opens New Options for Converters, Paperboard Packaging, June 1972, 44(17): 28-30, 65.

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78. Moving to Metric Makes Dollars and Sense; Dr. Daniel V. De Simone, Harvard Business Review, January - February 1972, p. 100-111.

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80. NASA Promotes the Metric System, paper presented to the American Ordnance Association, 29 March 1972, Milton W. Rosen, NASA HQ, Office of DOD and Interagency Affairs.

81. NASA Switches to Metric System, The Huntsville, AL, Times, 4 Oct. 1970.

82. National Bureau of Standards, The -, An Expanding Responsibility in the Seventies, Dr. Myron Tribus, NBS, presented at the American Institute of Industrial Engineers, MSFC, 1 Oct. 1970.

83. National Metrication is Now in Sight; Louis F. Sokol, President, Metric Association, Presented at MSFC, 26 February 1971.

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86. New Look at the U.S. Switch to Metrics, A -, Schultz, Gregory V., Factory. March 72, 5(3): 27-33.

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97. Report of the National Metric Study Conference on Engineering Industry, presented by Henry C, Parson, P. E., Product Manager, International Operation, Vickers Division, Sperry Rand Corp., at the Annual Meeting of the Metric Association, 28 December 1970, Chicago, IL.

98. Role of the Standards Engineer in Metrication, The -, Rowland Hill, Research and Development Laboratories, Ottawa, Canada, Standards Engineering, February 1971, p. 7-12.

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100. SI for Metric Medicine; Huth, E. J. Annals of Internal Medicine, Feb. 1972, p. 322-323.

101. SI Metric Units - Now ! Jim Palmer, Brown Engineering Co., Industrial Research, Feb. 1968, p. 70-74.

102. Some Aspects of Metrication. Butcher, F. E., Plant Engineer, v. 12, Dec. 1968. p. 749-753.

103. Standard Procedure for Using Units of Mass, Weight, Pressure and Acceleration, A. M. Schuler, Report No. DT-TM-1-60; 1 March 1960, Army Ballistic Missile Agency, Redstone Arsenal, AL.

104. Status and Progress of Metrication Throughout the World; Louis F. Sokol, Traffic Engineering, Nov. 1971.

105. Study to Develop an Optimum Metric Fastener System, A -, Engineering Report, 1971, Industrial Fastener Institute, 1505 East Ohio Bldg., 1717 E. 9th Street, Cleveland, OH 44114.

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109. Units and Systems of Weights and Measures, Their Origin, Development and Present Status, Judson, Lewis V., NBS Letter Circular 1035, Jan. 1960, NSIC: QC 89 J 93.

110. U.S. is Going Metric for Economic Reasons, Sylvia Porter, Huntsville, AL, Times, 30 July, 1971.

111. U.S. Plants Can Take Lessons from Britons on Metric Conversion, Modern Manufacturing, Oct. 1969, 2:108-110.

112. U. S. prepares to convert to the Metric System of Measurements, Leon Schloss, Senior Editor, Government Executive, December 1971, p. 40-41.

113. U. S. Slowly Centimetering Way to Metric System, McDaniel, C. G., Huntsville, AL, Times, 16 April, 1972.

114. Use of the International System of Units (SI) in NASA Publications, NASA Policy Directive NPD 2220.4, 14 September 1970.

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119. We can't lick 'em; so we better go metric soon: Hall, F. Machinery, v. 76, December 1970: 36-9; v. 77, February 1971: 45-8.

120. What's all this about Metrication ? MacDonald, B. I., Chemical Engineering Progress, v. 66, May 1970: 345.

121. What to do when Metric comes: (or, some engineering guidelines for converting your firm or office to the metric system), George C. Lovell, P. E., Professional Engineer, December 1970.

122. When 34-24-34 becomes 86-61-86, Kroeze, H., Industrial Engineering, February 1972, 4 (2): 10-13.

123. Why We Must "Go Metric", Dr. Lewis M. Branscomb, Commerce (Chicago Chamber of Commerce), June 72, :19-21, 58.

124. Will the U.S.A. Go Metric ?, KBI News, vol. 14, No. 3, 1970, p. 14-15, P. O. Box 1462, Reading, PA 19603.

125. World of Metric Measures Closes in on the U.S.A., Robert W. Carson, Product Engineering, 3 June, 1968.

126. Writing Figures the SI Way, Oliver Stewart, New Scientist, 8 June, 1972, p. 572.

C. PERIODICALS

available at the Redstone Scientific Information Center.

1. British Standards Institution News, London, England; monthly.
2. Canadian Standards Association, Rexdale, Ontario, Canada; quarterly.
3. Going Metric, (British) Metrication Board, London, England; quarterly.
4. Magazine of Standards, American Standards Institute, Ney York, NY; monthly.
5. Metric Association Newsletter, Metric Association, Inc., Sugar Loaf Road, Salina Star Route, Boulder, CO 80302; quarterly.
6. Metric Information Service, Rovipress, Ltd., 8-10 Parkway, London NW1, England (on order).
7. Metrication News, Rovipress, Ltd., 8-10 Parkway, London NW1, England, (on order) bimonthly, LC: No. QC 91.M38.
8. Metrication Newsletter, GKN Group Metrication Officer, Birmingham, England, Start: Feb. 1971, published at random intervals.
9. Standardisation, Directorate of Standardisation, Ministry of Defence, London, England.
10. Standardization, News Magazine of the American Standards Association, Inc., New York, NY; monthly.
11. Standards/Canada Newsletter of the Canadian-Standards Association, Rexdale, Ontario, Canada, published every two months.

D. METRIC LEGISLATION

The "Metric Conversion Act of 1972", originally introduced to Congress as Senate Bill S 2483 by Senator Claiborne Pell (D-RI) on 6 August 1971, and later modified, calls for the creation of a 11 member National Metric Conversion Board, drawn from industry, trade and labor associations and citizen groups, to plan and coordinate a voluntary ten-year change-over to predominantly metric units, an approach similar to the current British program. It also states that "costs will lie where they fall".

This bill has been approved unanimously by the Senate on 18 August 1972 and is now awaiting action in the House of Representatives.

E. FILM (16 mm)

1. Discover ..... Why Metric, 14 minutes, color, Regal-Beloit, Box 58, South Beloit, IL 61080 (on order).

2. Design, 15 minutes, British Information Office, 845 Third Ave. New York, NY 10022.

3. Going Metric, Central Film Library, London, England*, sound, black and white, 29 minutes, GB 1968; also: Time-Life Films, Inc., 43 West, 16th Street, New York, NY 10011. Study of a British factory in conversion with costs of metric drawings, best conversion time period, need for metric drills, taps, and tools, converting lathes, dialing and digital read-out, and training apprentices. For adults already conversant in shop practices.

4. Industrial Design, 10 minutes. British Information Office, 845 Third Ave., New York, NY 10022. (on order).

5. Industry Goes Metric, Central Film Library, England*, sound, color, 30 minutes. This film shows the advantages of metric measures and why they are being adopted by industry. Aimed at middle management, the film will be of interest also to engineers, technicians, machine operators and young people. - Managers from industrial companies discuss their reasons for going metric and how they go about it. Reference is made to opportunities for rationalization of designs and products, stocks and procedures. Lord Ritchie-Calder, Chairman of the British Metrication Board, outlines the functions of the Board. The roles of the industry and the British Standards Institution are described.

6. International System of Units, 22 minutes, color, King Screen Productions, 320 Aurora Ave. North Seattle, WA 98109.

7. Its Later Than You Think, World Wide Pictures, Ltd., 34 Cursitor Street, London EC4, England, sound, color, 6 minutes, GB No. 1968.

8. Key to Metrication No.1: Planning Metrication, Central Film Library, England*, sound, color, 17 minutes. (UK No. 1994).
The Key to Metrication series of three films is mainly for the education of management and supervisory staff in industry. It is aimed at line management in the manufacturing industries. Case histories are used to show how any firm, large or small, can go metric with the minimum disturbance and maximum benefit.**

9. Key to Metrication No.2: Phasing-In Metric Design, Central Film Library, England*, sound, color, 15 minutes. (UK No. 1995).
Film shows metrication as it affects designers and draftsmen. Through examples, the film shows the gradual process of changing designs to metric. The interface technique, design modification and the timing of completely new metric designs are illustrated.**

10. Key to Metrication No.3: Metric Production and Inspection, Central Film Library, England*, sound, color, 14 minutes. (UK No. 1996).
Film identifies the important stages of the changeover to metric production within a firm. Emphasis is given to the value of introducing dual-dialing. It deals also with timing the replacement of tools and measuring devices, and discusses familiarization techniques.**

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* See "Addresses for Information".

** Script available on a loan basis.

11. Metric America, A -, A Decision Whose Time Has Come, National Bureau of Standards, sound, color, 35 minutes. Nov. 1971.
This film is a summary of the U. S. Metric Study presentation to the House of Representatives' Committee on Science and Astronautics on 14 September 1971 by Dr. Lewis M. Branscomb, Director of the National Bureau of Standards, and Dr. Daniel V. DeSimone, Head of the Metric Study Team at NBS. The film opens with the Secretary of Commerce making the first public announcement on 29 July 1971 of his recommendations to Congress for a metric program. The film includes graphic material and live props which illustrate some of the main points of the metric study report (Reference publication, same title, NBS SP 345).

12. Metric System, The -, McGraw-Hill Films, Test-Film Division, No. 682832, 13 minutes, color, (Junior High School Level).

13. Metrication, Management on -, two films, sound, color, 25 minutes each, British Broadcasting Corp., Villiers House, The Broadway, Ealing, London W5 2PA, England, (8-page outline available), (on order).
Films are designed for an audience of top management and metrication officers in all fields of industry where the changeover has already begun, or where the effects of metrication will be felt in the future, each of the two films deals with one basic aspect of metrication.
The first film, entitled "The Task for Management" places metrication in its current context, outlining government policy, the roles in the changeover of the British Metrication Board, the Confederation of British Industry, training boards and trade associations. Guidance on identification of the tasks to be carried out in completing the change in a company is given, including advice on the appointment of a metrication officer.
"Management of the Changeover" is the subject of the second film, which deals with the method of assembling the tasks already identified into a coordinated plan, in order to minimize costs and maximize benefits. The need for correct timing of the changeover and the implementation and monitoring of the program once established is emphasized.

14. Q. A., 14 minutes, British Information Office, 845 Third Ave. New York, NY, (on order).

15. Talking Metric, Central Film Library, England*, sound, black and white, 30 minutes, GB No. 1968; also: Time-Life Films, Inc., 43 West, 16th Street, New York, NY 10011.
Panel discussion throughout by Britain's specialists metrology, government, industry, education and commerce discussing 1969 plans, progress and advantages of conversion. Mainly for motivated adults and metrication coordinators.

For additional information on the above listed films call:

Dr. William A. Mrazek or Mr. Harry L. Atkins
Metrication Task Group
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812
PD-DIR
Tel.: (205) 453-2155.

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* See "Addresses for Information".

F. FILMSTRIPS (35 mm) (All Junior High School Level)

1. Metric System, Film Strip-of-the Month Club, No. 1236, Elementary Mathematics, 1967, 40 frames.
2. Metric System, The -,McGraw-Hill Book Co., No. 643015, General Mathematics Series, 1961, 44 frames.
3. Metric System, The -, Eye Gate House, Inc., 146-01 Archer Ave. Jamaica, NY 11435, No. 5-1-8, Mathematics in Action, 1968, 44 frames.
4. Metric System, The -, 6 color film strip with 6 records and manual. Pathescope Educational Films, Inc., 71 Weyman Ave. New Rochelle, NY 10802.
5. Metric System of Measuring, The -, Encyclopedia Britannica, Films, Inc., No. 11121 C-81 Measuring. 1966, 52 frames.
6. Metric Weights & Measures, Library Filmstrip Center, 3033 Aloma, Wichita, Kansas 67211, 1969, 59 frames, color, with phonotape in cassette. Call No. 78-732812.
7. Units of Measurements, Jam Handy Organization, 1944, University of Alabama, Huntsville, AL, Code: 12, No. 2.
8. Using the Metric System, F-O-F Film Strips, Popular Science Publishing Co., No. 185, 1967, 43 frames.

G. METRIC EXHIBITS

1. National Bureau of Standards "Metric Information Center". About 3 m display front (photos on request).
2. A metric exhibit exists at the Marshall Space Flight Center, consisting of two units, each measuring 1.5 m wide and deep, 2 m high and weighing 300 kg. Each unit can be unfolded at the exhibition place resulting in 4 modules hinged together at the diagonal corners. One module has a slide projector with rotary drum for continuous showing. Slides are included. It works in conjunction with a tape recorder. Tapes are furnished. This exhibit is available on a loan basis at no cost except return transportation. Photos on request.

   Handouts: More than 50 types of handouts, small posters for blackboards, pocket cards are available, samples are compiled in three loose-leaf folders: "Metric Material", Vol. I, II and III.

For additional information call:

Dr. William A. Mrazek or Mr. Harry L. Atkins
Metrication Task Group
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812
PD-DIR
Tel.: (205) 453-2155.

H. METRICATION POSTERS

1. "Think Metric" posters, set of 6, National Microfilm Association, Suite 1101, 8728 Colesville Road, Silver Spring, MD 20910.
2. (British) Construction Industry Training Board:*

   No. 1: Miss Metric
   No. 2: The Foot
   No. 3: The Stamp
   No. 4: Four Temperatures
   No. 5: Super
   No. 6: Keep a Cool Head
   No. 7: Down a Litre
   No. 8: The Weigh-In.

3. Metrication Board, 22 Kingsway, London WC2, England.
4. Pictorial Charts Educational Trust, 132 Uxbridge Road, London W13, England.

I. EDUCATION AND TRAINING COURSES

1. Center for Metric Education: Western Michigan University, Kalamazoo, MI, Directors: Dr. John L. Feirer, Head of the Department of Industrial Education, and Dr. JohnR. Lindbeck, Professor of Industrial Education.
2. University of Southern Mississippi, Department of Science Education, Project for Metric Research, Hattiesburg, MS 39401, Director: Prof. John W. Flowers.
3. George Washington University, DC.
4. Colorado State, College of Education, Greenly, CO.
5. Thomas Nelson Community College, Hampton, VA, Courses on the use of the International System of Units (ISU).
6. University of Kentucky, Mechanical Engineering Department, Lexington, KY 40506, Prof. Dr. Uri Gat.
7. Metric Orientation for U. S. Management Industry, video tape, 60 min., Society of Manufacturing Engineers, 20501 Ford Road, Dearborn, MI 48128, Tel.: (313) 271-1500.
8. Metric in the Office, C/1 (2nd Edition, Aug. 1969), (British) Construction Industry Training Board.*
9. South African Bureau of Standards: *

   M 3: Metric sizes for basic materials
   M 13: Recommended practice for building drawings
   M 19: Metrication for the family
   M 25: Metrication for the farmer
   M 27: The use of SI in primary education
   M 28 Metrication for the typist.

10. Check for self-learning textbooks.*
11. "GO METRIC" dice game from Zambia. The Zambia Metrication Board, Box 1968, Lusaka, Zambia.

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* See "Addresses for Information".

J. INTERNATIONAL STANDARDS

I. International Organization for Standardization (ISO)

1. R 1 -1954 Standard Reference Temperature for Industrial Length Measurements.
2. R 31-I -1965 Basic Quantities and Units of the SI.
3. R 68 -1969 General Purpose Screw Threads, Basic Profile.
4. R 128 -1959 Engineering Drawing, Principles of Presentation.
5. R 129 -1959 Engineering Drawing, Dimensioning.
6. R 225 -1961 Bolts, Screws and Studs, Dimensioning.
7. R 261 -1969 General Purpose Metric Screw Threads, General Plan.
8. R 262 -1969 General Purpose Metric Screw Threads, Selected Sizes for Screws, Bolts and Nuts.
9. R 272 -1968 Hexagon Bolts and Nuts: Width Across Flats, Heights of Heads, Thickness of Nuts; Metric Series.
10. R 273-I -1962 Clearance Holes for Metric Bolts.
11. R 273-II -1968 Clearance Holes for Metric Bolts 42 up to and including 150 mm Thread Diameter.
12. R 286-I -1962 System of Limits and Fits, Part I: General, Tolerances and Deviations.
13. R 288 -1963 Slotted and Castle Nuts with Metric Thread.
14. R 288-II -1969 Slotted and Castle Nuts with Metric Thread; 42 up to and including 100 mm Thread Diameter.
15. R 370 -1964 Conversion of Toleranced Dimensions from Inches into Millimeters and Vice Versa.
16. R 388 -1964 Metric Series for Basic Thicknesses of Sheet and Diameters of Wire.
17. R 463 -1965 Dial Gauges Reading in 0.01 mm, 0.001 in. and 0.0001 in.
18. R 623 -1967 Paper and Board, Sizes of Folders and Files.
19. R 701 -1968 International Gear Notation: Symbols for Geometrical Data.
20. R 724 -1968 ISO General Purpose Metric Screw Threads: Basic Dimensions.
21. R 725 -1968 ISO Inch Screw Threads: Basic Dimensions.
22. R 733 -1968 Hexagon Bolts and Nuts Metric Series: Tolerances on Width Across Flats, Widths Across Corners.
23. R 861 -1968 Hexagon Socket Head Cap Screws, Metric Series.
24. R 885 -1968 Bolts and Screws, Radii Under the Head for General Purpose Bolts and Screws.
25. R 887 -1968 Washers for Hexagon Bolts and Nuts, Metric Series.
26. R 888 -1968 Nominal Lengths for Bolts, Screws and Studs, Thread Length for General Purpose Bolts.
27. R 898-I -1968 Mechanical Properties of Fasteners, Part I: Bolts, Screws and Studs.

28. R 898-II -1969 Mechanical Properties of Fasteners Nuts with Specified Proof Load Values.

29. R 898-III-1969 Mechanical Properties of Fasteners, Marking of Bolts, Screws, Studs, and Nuts.

30. R 965-I -1969 ISO General Purpose Metric Screw Threads Tolerances Principles and Basic Data.

31. R 965-II -1969 ISO General Purpose Metric Screw Threads, Tolerances, Limits of Sizes for Commercial Bolt and Nut Threads, Medium Quality.

32. R 965-III-1969 ISO General Purpose Metric Screw Threads Tolerances Deviations for Constructional Thread.

33. R 1000 -1969 Rules for the Use of Units of the International System of Units and a Selection of the Decimal Multiples and Sub-Multiples of the SI Units.

34. R 1119 -1969 Series of Conical Tapers and Taper Angles.

35. R 1122 -1969 Glossary of Gears, Geometrical Definitions.

36. R 1207 -1970 Slotted Cheese (Fillister) Head Screws.

37. R 1478 -1970 Tapping Screw Thread.

38. R 1479 -1970 Hexagon Head Tapping Screws, Metric Series.

39. R 1481 -1970 Slotted Fan Head Tapping Screws.

40. R 1482 -1970 Slotted Countersunk (flat) Head Tapping Screws.

41. R 1483 -1970 Slotted Raised Countersunk (oval) Head Tapping Screws.

42. R 1580 -1970 Slotted Fan Head Screws, Metric Series.

43. R 1661 -1971 Technical Drawings - Tolerances of Form and of Position - Part IV: Practical Examples of Indications on Drawings.

44. R 1829 -1970 Selection of Tolerance Zone for General Purposes.

45. R 1938 -1971 ISO System of Limits and Fits - Part II: Inspection of Plain Workpieces.

46. R 2091 -1971 Hydraulic Cylinders - Internal Diameters and Piston Road Diameters - Metric Series.

II. International Electrotechnical Commission (IEC)

1. 68-1&2 (1968-1971) Basic Environmental Testing Procedures for Electronic Components and Electronic Equipment, Part 1 and 2.
2. 97 (1970) Grid System for Printed Circuits.
3. 103A (1970) Supplement to Publication 103, Aluminum Electrolytic Capacitors for Long Life (Type 1) and for General Purpose Application (Type 2).
4. 115-3 (1971) Fixed Resistors, Part 3: Wirewound Resistors, Type 1, Selection of Methods of Test and General Requirements.
5. 117-3A (1970) Supplement A to Publication 117-3 (1963). Recommended Graphical Symbols, Part 3: Contacts, Switchgear, Mechanical Controls, Starters and Elements of Electro- Mechanical Relays.
6. 130-1 (1962) Connectors for Frequencies below 3 MHz, Part I: General Requirements and Measuring Methods.
7. 147-3 (1970) Essential Ratings and Characteristics of Semiconductor Devices and General Principles of Measuring Methods. Part 3: Reference Methods of Measurements.
8. 249-1A (1970) First Supplement to Publication 249-1 (1968) Metal-clad base materials for printed circuits. Part 1: Test Methods.
9. 255-2 (1969) Electrical Relays, Part 2: Specified - time all-or-nothing relays.
10. 309 (1969) Plugs, socket-outlets and couplers for industrial purposes.
11. 319 (1970) Presentation of reliability data on electronic components (or parts).
12. 321 (1970) Guidance for the design and use of components intended for mounting on boards with printed wiring and printed circuits.
13. 324 (1970) Ceramic dielectric capacitors, Type 3.
14. 326 (1970) General Requirements and Measuring Methods for Printed Wiring Boards.
15. 352 (1971) Solderless Wrapped Connections, General Requirements, Test Methods and Practical Guidance.

K. CONVERSION TOOLS

1. A variety of short general purpose conversion charts covering many fields too numerous to list here are available.

2. English-Metric Instant Conversion (Tables), E. Joe Penn, 1969.

3. Computerized conversion tables of customary units to metric units and vice versa. All tables range from 0 to 1.050 units in increments of 0.001 units. Converted values are printed to five places or more:

LENGTH			MASS			ANGLE		
in	-	cm	oz(Avoir)	-	kg	sec	-	rad
ft	-	m	oz(Troy)	-	kg	min	-	rad
miles	-	km	lb	-	kg	deg	-	rad
fathom	-	m	grain	-	kg			
parsec	-	m				VELOCITY		
AU	-	m	FORCE			in/s	-	m/s
light year	-	m	oz	-	N	ft/s	-	m/s
			lb	-	N	km/h	-	m/s
						mile/h	-	m/s
AREA			PRESSURE			ENERGY		
$inch^2$	-	cm^2	psi	-	N/cm^2	BTU	-	Joule
ft^2	-	m^2	atm	-	N/cm^2	CAL	-	Joule
$yard^2$	-	m^2	in-mercury	-	N/cm^2			
acre	-	m^2	Torr	-	N/cm^2	POWER		
						BTU/s	-	kW
VOLUME			DENSITY			BTU/min	-	W
in^3	-	cm^3	lb/in^3	-	kg/m^3	ft-lb/s	-	W
ft^3	-	m^3	lb/ft^3	-	kg/m^3	HP	-	kW
yd^3	-	m^3						
gal	-	m^3						

4. Computerized conversion table inch to millimeters, range: 0 to 1.1799 inches in increments of 0.0001 inch, accurate to 0.0001 inch.

5. Pound to kilogram conversion (one-way only) accurate to one gram (g).

   a. 0- 20 lbs, in increments of 0.1 lb.
   b. 0-500 lbs, in increments of 1 lb.
   c. 0-2000 lbs, in increments of 2 lbs.

6. Conversion Charts for Temperature:

   a. °C to °F b. °C to °F change c. Kelvin (K) to Rankin (R)

7. Computer Conversion Service (MSFC only). For details call

   Mr. W. F. Crumbley
   NASA
   George C. Marshall Space Flight Center
   Marshall Space Flight Center, AL 35812
   S&E-COMP-RDC
   Tel.: (205) 453-5941.

L. ADDRESSES FOR INFORMATION

1. American National Standards Institute
   1430 Broadway, New York, NY 10018

2. American Society for Testing and Materials
   1916 Race Street, Philadelphia, PA 19103
   Tel: (215) 569-4200

3. British Book Center, Inc.
   996 Lexington Ave. New York, NY
   Tel: (212) 879-6577

4. British Metrication Board
   Chairman: Lord Ritchie-Calder
   22 Kingsway, London WC2, England

5. British Standards Institution
   2 Park Street, London W1Y 4AA, England

6. Canadian Metric Association, The -,
   President: Prof. Guy M. Richard,
   P. O. Box 35, Fonthill, Ontario, Canada

7. Canadian Standards Association
   178 Rexdale Boulevard, Rexdale, Ontario, Canada

8. Center for Metric Education
   Directors: Dr. John L. Feirer, Dr. John R. Lindbeck
   Western Michigan University,
   Kalamazoo, MI
   Tel: (616) 383-1600

9. Central Film Library
   Government Building
   Bromyard Avenue
   London W3, England

10. Construction Industry Training Board (CITB)
    Radnor House, London Road, Norbury SW16,
    London, England

11. Dr. Daniel V. DeSimone
    Office of Science & Technology
    Executive Office of the President
    The White House, Washington DC 20506

11. ISO/TC20, Aircraft and Space Vehicle
    US Representative, Mr. M. Leroy Stoner
    Manager, Technical Division
    Society of Automotive Engineers, Inc.
    2 Pennsylvania Plaza, New York, NY 10001
    Tel: (212) 594-5700

12. Metric Association, Inc.
    President: Louis F. Sokol
    Sugarloaf Road, Salina Star Route
    Boulder, CO 80302
    Tel: (303) 442-3342
    Secretary: Dr. Richard W. Mattoon
    Chemical Physics, Dept. 482
    Abbott Laboratories
    North Chicago, IL 60064
    Tel: (312) 688-7178

Treasurer: Fred J. Helgren
2004 Ash Street
Waukegan, IL 60085
Tel: (312) 623-2212

13. Metrication Board of Zambia, The -,
P. O. Box 1968
Lusaka, Zambia

14. National Bureau of Standards
Washington, DC 20234
Dr. Louis E. Barbrow, Consultant and Coordinator Metric Activities
Tel: (301) 921-2658
Mr. Jeffrey V. Odom, Metric Study Program
Tel: (301) 921-3651
Mr. W. N. Tilley, Chief, Office of Technical Information and Publications
Tel: (301) 921-2493

15. Normenstelle Luftfahrt, NL
7022 Leinfelden
Dreimorgenstr. 8
West Germany

16. Overseas Film Library
Central Office of Information
Hercules Road, Westminster Bridge Road
London SE1, England

17. Rovipress Ltd.,
Metric Information Service
8-10 Parkway
London NW1, England

18. South African Bureau of Standards
Private Bag 191
Pretoria, South Africa

19. Standards Association of Australia
80-86 Arthur Street
North Sidney, Australia

20. Superintendent of Documents,
US Government Printing Office
Washington DC 20402

21. University of Southern Mississippi
Department of Science Education
Project for Metric Research
Southern Station, Box 403
Prof. John M. Flowers, Director
Hattiesburg, MS 39401
Tel: (601) 266-7213 or 7148

M. SOURCES OF METRIC TOOLS, INSTRUMENTS, COMPONENTS, ETC.

The following is a preliminary, representative list of manufacturers producing metric items or rendering metric services. This list does not represent endorsement of these manufacturers or products; it is given for information only:

1.	Acme Shear Co., The - 100 Hicks Street Bridgeport, CT 06609	(203) 384-1371	Westcott rulers: combination inch-metric rules in 15, 30, 38, 50 and 100 cm sizes
2.	Adams Tool & Supply Co. 1630 W. Armitage Ave. Chicago, IL 60622	(312) 278-2070	Measuring instruments; Conversion tables, drills, taps, dies, fasteners, gages
3.	American National Standards Institute, Inc. 1430 Broadway New York, NY 10018	(212) 868-1220	Engineering Standards, incl. ISO and IEC International Standards
4.	American Society for Testing and Materials, Inc. 1916 Race Street, Philadelphia, PA 19103	(215) 569-4200	Conversion slide rules: U. S. Customary to SI units
5.	Atlantic Industrial Corp. 555 Lehigh Ave. Union, NJ 07083	(201) 687-5900	Measuring tape in metric units (2 m length)
6.	Bellmore Precision Components Co., 1975 Newbridge Rd. Bellmore, NY 11710	(516) 785-4628	Metric precision machined products
7.	Beloit Tool Corp. P. O. Box 38 South Beloit, IL 61080	(815) 398-3461	Taps, dies, drills, thread gages, reamers, fasteners, educational material (books, films)
8.	Bevco P. O. Box 5023 Glendale, CA 91201	(213) 849-1474	Metric tools, wrenches, measuring instruments
9.	Bishop Graphics, Inc. 7300 Radford Ave. North Hollywood, CA 91605	(213) 982-2000	Printed wiring art work
10.	Borkin Co., R. A. 7465 Mohawk Road Milwaukee, WI 53217		Metric reamers
11.	British Alum Norfolk House, Norfolk Square London, England		Aluminum products to metric and ISO engineering standards
12.	Brooks, T. J., Ltd., Barkby Road, Leicester LE4 7HX England		ISO Metric fasteners for aerospace according to LN Standards
13.	Brown & Sharp Mfg. Co. Precision Park North Kingstown, RI 02852		Metric tools
14.	Bucher & Mayer GmbH Stuttgart-Bad Cannstadt Reichenbachstrasse 24 West Germany		Metric hand tools "Gedore"
15.	C.E.M. Co., Inc. 24 School Street Danielson, CT 06239	(203) 774-8571	Spring pins in metric sizes

16. C-Thru Ruler Co. 3 Britton Drive Bloomfield, CT 06002	(203) 243-0303	English-metric slide rule conversion
17. Cambridge Thermionic Corp. 445 Concord Ave. Cambridge, MA 02138	(617) 491-5400	Terminals, terminal boards, coils, chokes, coil forms, connectors (Metric Catalog M 747)
18. Cap Screw & Nut Co. 197 Fabyan Place Newark, NJ 07112	(201) 374-4300	Metric bolts, nuts and washers
19. Chicago-Latrobe Division 411 W. Ontario Street Chicago, IL 60610	(312) 337-6727	Drills, reamers, (drill chart)
20. Commonwealth Tools & Specialties Corp. 89 Greene Street New York, NY 10012	(212) 966-2151	Taps, drills, reamers, fasteners
21. Cooper Thermometer Co., The - Reed's Gap Road Middlefield, CT 06455	(203) 349-3473	Celsius scale thermometers
22. Daystrom, Inc. Western Instruments & Electronics Division 736 S. Monterey Pass Road Monterey Park, CA 91754	(213) 268-9271	Celsius scale thermometers
23. Deltronics Corp. 929 Baker Street Costa Mesa, CA 92626	(714) 545-0401	Precision gages (Millimeter-inch equivalent reference charts)
24. Dexter & Co. (High Wycombe) Ltd. Queens Road, High Wycombe, Buckinghamshire, England		Machine tool conversion dials "High Speed Dexter Twin Dial"
25. Dice Company, J. W. 16 Highwood Avenue Englewood, NJ 07631	(201) 569-0471	Electronic micrometers readable to 0.002, 0.001 and 0.0002 mm
26. Dietzgen 2425 N. Sheffield Ave. Chicago, IL 60614	(312) 549-3300	Metric drawing equipment and supplies
27. du Mont Corp., The - 40 Riddle Street Greenfield, ME 01301	(413) 773-3674	Metric keyway broaches, cutters, tool bits
28. Durakut International Corp. 22-T Central Drive Farmingdale, NY 11735	(516) 293-4920	Metric dies
29. Durr Surgical Supply Co. 10005 Memorial Parkway SW Huntsville, AL	(205) 881-7540	Metric measuring cups, kg- scales
30. Dzus Fastener Co., Inc. 425 Union Blvd. W. Islip, NY 11795	(516) 669-0494	Metric fasteners

31. Echo, Inc. 322-624 East Main Street Springfield, OH 45503	(513) 322-4973	Celsius scale thermometers, wall type
32. Edmund Scientific Co. Edscorp Bldg. Barrington, NJ 08007	(609) 547-3488	Tools, measuring instruments, tap & die sets, drills, scales
33. Educational Supply Co. 105 Brisbane Road Downsview, Ontario, Canada		Metric teaching aids "Osmiroid Centicubes"
34. Elastic Stop Nut Division Amerace ESNA Corp. Union, NJ	(201) 686-6000	Metric and ISO fasteners
35. Engis Equipment Co. 8035 Austin Ave. Morton Grove, IL 60053	(312) 966-5600	BSI metal conversion slide rule
36. Fairbank Morse 711 E. Street St. Johnsbury, VT 05819	(802) 748-2371	Weighing systems, scales
37. Fairgate Rule Co., Inc. Cold Spring, NY 10516	(914) 265-3677	Aluminum rules in 60, 100 and 200 cm (one piece)
38. Fisher & Crome 2427 N. Mascher Street Philadelphia, PA 19133	(215) 426-3232	Metric templates
39. Fisher Scientific Co. 203 Fisher Bldg. Pittsburgh, PA 152[illegible]	(412) 391-1330	Laboratory equipment with metric units
40. Fisher Special Mfg. Co. 447 Morgan St. Cincinnati, OH 45206	(513) 916-1280	Metric nuts
41. Drs. Uri Gat, P.E. and O.J. Hahn 318 Sheridan Drive Lexington, KY 40503	(606) 277-6017 272-2926	Metric consultants
42. General Hardware Mfg. Co. 80 White Street New York, NY 10013	(212) 227-2647	Metric steel rules, vernier and micrometer calipers, hand tools
43. GKN International 1133 Ave. of the Americas New York, NY 10036	(212) 765-2020	Fasteners
44. Graham, John H. & Co., Inc. 14 Thomas Street New York, NY 10007	(212) 962-2250	8-ender metric socket wrench tool (8 different sockets)
45. Hamilton Scale Corp. 3350 Secor Road Toledo, OH 43606	(419) 474-2151	Weighing systems, scales
46. Hanson Scale Co. 1775 Shermer St. Northbrook, IL 60062	(312) 272-1100	Utility scales in grams and kg.

47.	Hardware & Industrial Products Div, H.K. Porter Co. 300 Porter Bldg. Pittsburgh, PA 15219	(412) 391-1800	Disston 2 and 2.5 m flexible steel tape rules
48.	Hartley Gove Sons P. O. Box 909-T Brookhaven, Miss. 39601	(601) 833-2911	Celsius scale thermometers
49.	Hi-Shear Corp. Sky Park Drive Torrance, CA 90509	(213) 326-8110	Metric fasteners
50.	HJS Engineering Co. 5215 N. Marmora Ave. Chicago, IL 60630		Metric machines, tools, and measuring equipment. Conversion service from inch to metric
51.	Hobart Mfg. Co., The - P. O. Box 11989-T Columbia, SC 29211	(803) 754-8800	Weighing systems, kg scales
52.	Howe Richardson Scale Co. 680 Van Houten Ave. Clifton, NJ 07015		Weighing systems, kg scales
53.	Hubbel, Inc., Harvey - Bridgeport, CT 06602		Metric fasteners
54.	INA Bearing Co., Inc., INA Drive Cheraw, SC 29520	(803) 537-2106	Metric bearings
55.	Ideal Aerosmith, Inc. Box 269-T Cheyenne, WY 82001	(307) 634-7714	Machine tool conversion "Koder II"
56.	Imperial Eastman Corp. 6300 W. Howard Street Chicago, IL 60648	(312) 774-1700	Metric size tools for tube bending and flaring
57.	Information General Corp. Woodland Hills, CA		Metric converters
58.	Innovative Management Systems President: Joseph L. Pokorney P. O. Box 367 Northbrook, IL 60062	(312) 272-3170	Metric consulting services
59.	International Wire Machinery Corp., 16 W. 46th Street New York, NY 10036	(212) 756-1860	Metric bearings
60.	Isaac Co., The - 595 E. Gailbrath Rd. Cincinnati, OH 45215	(513) 761-8855	Pressure gages
61.	Kelm Manufacturing Co. Route No. 2 Coloma, MI 49022	(616) 925-6372	Metric-English conversion kits (calculator and graphic charts)
62.	Keuffel & Esser Co. 303 Adams Street Hoboken, NJ 07030	(201) 659-1100	Drawing instruments, graph paper, scales for drafting machines

63. Kirby Advertising Specialties (205) 539-2001
823 Chamber Drive NE
Huntsville, AL
Plastic pocket cards with metric conversion figures

64. Klimo und Bongartz
2000 Hamburg 70
Tratzingerstr. 21
West Germany
International traffic signs

65. Kromhard Twist Drill Co. (216) 535-7129
1095 Sweitzer St.
Akron, OH 44301
Metric drill, taps, dies

66. Laboratory Supplies Co., Inc. (516) 681-7711
29 Jefry Lane
Hicksville, NY 11801
Metric laboratory supplies

67. Lion Tool & Gage Co. (313) 545-2888
24039 Dequindre Road
Hazel Park, MI 48030
Metric dies

68. Mac Tools, Inc. (513) 684-2411
197 Jefferson Street
Sabina, OH 45169
Metric tools, taps and dies

69. Metra-Tech Corp. (301) 822-3486
P. O. Bx 699
Easton, MD 21601
Attachment to machine tools to provide simultaneous inch-metric read-out with certified accuracy

70. Metric-Aids
75 Horner Ave.
Toronto 530, Ontario, Canada
Metric teaching aids

71. Metric Association, Inc. (303) 442-3342
Sugarloaf Road
Salina Star Route
Boulder, CO 80302
Metric promotion material: rules, meter sticks, measuring tapes, Celsius thermometers, GO METRIC bumper stickers and lapel pins

72. Metric & Multistandard Components Corp. (914) 592-4020
198-200 Saw Mill River Road
Elmsford, NY 10523
Metric fasteners, calipers, micrometers, hand tools, taps, dies

73. Metric Div., US Socket Screw Corp., 126-T Lafayette (212) 925-5645
New York, NY 10013
Metric fasteners, nuts, taps; wrenches, tools

74. Micro Metrics, Inc. (201) 478-8440
253 Crooks Ave.
Clifton, NJ 07011
Metric gears

75. Milbern Co.
P. O. Box 51
New York, NY 10009
Circular metric charts with machinists drilling, tapping and clearance data

76. Millimeter Industrial Supply Corp., 162 Central Ave. (212) 937-1154
Farmingdale, NY 11735
Metric fasteners, calipers, feeler gages, drills, wrenches, taps, dies, cutters

77. Mills Resistor Co. (213) 598-2454
10810 Kaylor Street
Los Alamitos, CA 90720
Precision wirewound resistors featuring metric measurements

78. Montgomery Ward Retail Stores		Automotive wrenches, socket, box and open end
79. Nadash, André Box 356 Riverdale, MD 20840		Metric consultant
80. National Camera, Inc. Englewood, CO 80110		Hand tools, micrometers, calipers, drills
81. National Microfilm Association 8728 Colesville Road Silver Spring, MD 20910		"Think Metric" posters
82. New Era Conversion Co. District Bank Chambers Market Place Hinckley, Leics., England		Machine tool conversion dials, "Unidial"
83. Ohaus Scale Corporation 35 Hanover Road Florham Park, NJ 07932	(201) 377-9000	Laboratory balances and weights, elementary measurement kit for classroom use with balance, weights, rulers, calipers and booklets
84. Omaro 13 Rue de la Nation Paris 18, France		Conversion slide rule ("C.8"). French-British-American "Gabarit"
85. Pelouze Manufacturing Co 1208 Chicago Ave. Evanston, IL 60202	(312) 328-8330	Weighing systems, scales
86. Penn, E. Joe 4910 Carson Ave. Indianapolis, IN 46227	(317) 786-8070	Inch-mm conversion booklet, wall charts
87. Pic Design Corp. Box 335 Ridgefield, CT 06877	(203) 438-0345	Metric racks and pinions
88. Polymetric Services President: R. A. Hopkins 4600 Brewster Drive Tarzana, CA 91356	(213) 881-2227	Metric consultants; educational and visual training aids, calculators and measuring devices
89. Production Tool Supply Co. 11311 E. Eight Mile Road Warren (Detroit), MI 48090	(313) 755-2200	Tools and metric supplies
90. Rapid Design, Inc. 2601 N. San Fernando Burbank, CA 91504	(213) 849-5007	Drawing templates
91. Reyher-Schrauben 2 Hamburg 50 Haferweg 3a West Germany		German standards bolts, nuts, washers and related nardware
93. Ridge Tool Co., The - 400 Clark Street Elyra, OH 44035	(216) 323-5581	Metric fasteners, pipes
94. Roechling Steel, Inc. 60 East 42nd Street New York, NY 10017		Finished steel products in ISO and metric standards

95.	Ronningen Metric Co. 6102 Palo Cristi Paradise Valley, AZ 85253		Conversion tools U.S.-Metric weights and measures
96.	Rosan, Inc. 2901 West Coast Hwy. Newport Beach, CA 92663	(714) 548-5533	Metric fasteners
97.	Sama & Etani, Inc. Groton, Mass. 01456		Reference tables and circular slide rules "Model 600"
98.	Sargent-Welch Scientific Co., The -, 7300 N. Linder Ave. Skokie, IL 60078		Aids for teaching the metric system: wall charts, measuring sets, decimeter cubes
99.	Science Associates, Inc. 230 E. Nassau St. Princeton, NJ 08540	(609) 924-4470	Weather instruments with metric graduations, thermometers, barometers, rain gages
100.	Scott Graphics Corp., Inc. 195 Appleton St. Holyoke, Mass. 01040		Metric measurements for micro-copying equipment, films and accessories
101.	Sears, Roebuck Retail Stores		Automotive wrenches: socket, box, and open end
102.	Shardlow Micrometers, Ltd. Box 62, Petre Street Sheffield 4, Yorkshire, England		Micrometers with dual US/Metric readings
103.	Siber Precision, Inc. 450 Barell Ave. Carlstadt, NJ 07072	(201) 939-8510	Metric vernier calipers
104.	Snap-On Tools Corp. 8049 28th Ave. Kenosha, WI 53140	(414) 654-8681	Metric wrenches, socket, box, and open end
105.	Standard Pressed Steel Co. Jenkintown, PA 19046	(215) 884-7300	Socket head cap screws, socket set screws, socket head hex keys also for aerospace application
106.	Standard Tool Co. 1630 N. Armitage Ave. Chicago, IL 60622	(312) 278-2070	Measuring instruments, conversion tables
107.	Starrett, L. S., The - 101 Crescent Street Athol, MA 01331	(617) 249-3551	Measuring instruments
108.	Staveley Machine Tools, Inc, 34 Tower Street Hudson, MA 01749	(617) 562-3444	Machine tool conversion dials
109.	Sunset House Beverly Hills, CA 90213		Label:"METRIC DESIGN - Use Proper Tools and Spare Parts"
110.	Swani Publishing Co. Box 248 Roscoe, IL 61073		Label:"USA Goes Metric" books: Introduction to Metric Units, ISO Metric Fastener Data
111.	TAD Products Corp. P. O. Box 25 Beverly, MA 01915	(617) 927-3555	English-Metric converters

112.	Tanner Enterprises 2011 Jordan Lane SW Huntsville, AL 35805	(205) 539-4009	ISO format and metric sizes stationery; Celsius fever thermometers, Celsius outdoor thermometers, chassis punches
113.	Taylor Instrument Companies Arden, NC 28704	(704) 648-8111	Thermometers, barometers, barographs, rain gages with metric scales
114.	Testometric Co., The - 100 A Market Street Hyde SK14 1ES, England		Conversion components and service for instruments and machines to metric units; replacement dials and scales
115.	Timken Roller Bearing Co., The- Canton, OH 44706	(216) 453-4511	Metric and ISO ball bearings
116.	Torrington Co., The - 59 Field Street Torrington, CT 06790	(203) 482-4441	Metric and ISO roller bearings
117.	Torsion Balance Co. 35 Mohegan Street Clifton, NJ 07013	(201) 473-6900	Precision weighing equipment, including weights, in the metric system
118.	Unz & Co. 24 Beaver New York, NY 10004	(212) 944-2075	Conversion tables
119.	Van Keuren Co., The - 176 Waltham Street Watertown, MA 02172	(617) 926-1450	Metric standards
120.	Veteran Tool & Supply co. 3 A Howard Street New York, NY 10013	(212) 925-0940	Metric nuts, screws, calipers, micrometers, hand tools, reamers, taps, dies, wrenches
121.	Vickers Ltd. Crayford Works Crayford, Kent, England		Machine tool conversion dials and units
122.	Weksler Instruments Corp. 195 E. Merric Road Freeport, Long Island, NY 11520		Thermometers, indicating, recording and controlling instruments with Celsius scales
123.	Williams, J. H. & Co. 420 Vulcan Street Buffalo, NY 14207	(716) 876-3200	Tools
124.	Wilson, Mr. Lloyd B. - 145 Tanners Pond Road Garden City, NY 11530		Metric conversion consultant
125.	Xcelite, Inc. Orchard Park New York, NY 14127	(716) 662-4461	Metric hand tools
126.	Zelenda Machine & Tools Corp. 66-02 Austin Street Forest Hills, NY 11374	(212) 896-2288	Metric nuts, bolts, fasteners, calipers, feeler gages, drills, wrenches, reamers, taps, dies.